FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 68 Thursday, November 5, 1942 No. 1368

Education of Foundry Apprentices

At this time of the year there is usually a spate of matter dealing with the education of the boy destined to become a skilled foundry worker. It should be remembered that when works' executives devote their thought to this subject, their outlook is coloured, and rightly so, by the observation of the material which has passed, and is passing, through their hands. On the other hand, to have profound knowledge of the training of youth necessitates a lifetime study, and errors may be made if the trade side, as against the cultural aspect, is too strongly impressed upon the curriculum of the elementary schools. There is a general agreement that the existing scheme is inadequately responding to current requirements, and needs modification. The problem which the educationalist has to face is (1) to give every youngster an equal chance to make the most of life; (2) to recognise that, broadly speaking, a percentage of the students must eventually earn their living as labourers; a second quota will be skilled artisans or the equivalent, and the balance will enter the professions; and (3) the higher the standard of the training reached, the greater the tendency there is to gravitate towards the professions. Cognisance must be taken of the statement by Mr. Kirby, the President of the Scottish Branch, that a trade apprenticeship must start at the age of 14, as 16 is too advanced to acquire practical skill with ease. This reversion to time-honoured custom, however, must be altered and improved by part-time study of technical and cultural subjects. A factor, which to our mind is of some importance, is that an early start should be made with home work. It does not have any deleterious effect upon the children attending private preparatory schools, and a habit so inculcated may help to pave the way for increased attendances at the evening classes, and decreased visits to the picture shows. There is the quite erroneous conception abroad that the *better education* of youth militates against taking service in the ranks of the skilled trades. Surely it is only a form of snobbishness which is operating, and " better education " would quickly eradicate the notion. A really higher standard of education, however, quite naturally suggests to the student the professions as the ultimate object to be sought. The solution of this very complex problem can only be found by those who are in a position to study it professionally, but it is the duty of every branch of industry to prepare and present to the authorities their considered views in the form of a memorandum acceptable as being truly representative. Such a report represents one of the raw materials of the educationalists and, failing its availability, they will put forward their own conceptions based on those received from other bodies, many of which are merely impractical strivings after the Utopian. With its 2,500 members, the Institute of British Foundrymen is in a unique position to advise the educational authorities of the views of an industry demanding very large numbers of every type of employee, from the handy labourer to the University graduate. Its members already possess much experience in the preparation of syllabuses for both elementary and advanced technological study courses, and they are cognisant of the outstanding defects in the present educational system. This experience and knowledge will be largely wasted, however, unless it is made available for those whose job it is to legislate for post-war educational changes. Moreover it is apparent from recent official announcements that the present need for youth in the engineering trades is so urgent, that immediate steps are being taken to enrol and train boys who " are mathematically or scientifically minded," and a campaign designed to further these ends has been launched. Here possibly is the key to the solution of the problem of getting the right type of boy into the foundry in the future, for with a background of science, foundry work can indeed be a fascinating occupation.

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NOTES FROM THE BRANCHES

MIDDLESBROUGH AND DISTRICT BRANCH

The opening meeting of the Winter Session of the Middlesbrough and District Branch on September 26 was held at The Imperial Hotel, Darlington, when Mr. F. Swift delivered his Presidential Address, in the course of which he said it was his earnest desire to uphold the very high standard which this branch has attained, and, if possible, to improve it. The past-President, Mr. Oliver Wilson, had had a very successful year, considering the war conditions. It would be of great satisfaction to the members to hear that the membership of the Branch for the first time in its history has exceeded the century. This was due to the enthusiasm of the Council and the honorary secretary, Mr. Smithson, who obviously devotes a great deal of time and energy for the benefit of all. In the last four years ten new members have joined the Branch from Darlington Forge alone, which in itself is praiseworthy. Mr. W. D. Pugh, the works superintendent, had given every consideration and assistance to encourage the foundry industry and this branch. Some of these new members, representing various occupations connected with foundry practice, should be able during the near future to give Papers or lectures which, from a practical point, might be difficult to excel.

The primary object of the Institute was to instil and increase knowledge in the various branches connected with ferrous and non-ferrous practice. He appealed to all to make a special effort to attend the various meetings. Travelling facilities may get worse, and every effort should be made to keep this Branch active, for by so doing there will be created that interest which is so important nationally, especially at the present time when all efforts are essential to see that the Services are supplied with the necessary equipment so vital to win this war, and thereby ensure harmony throughout the world.

Moulder Training and Research

For maintaining and improving the standard of the foundry industry, the fullest co-operation of all connected was necessary, including employers, designers, draughtsmen, patternmakers, dressers, etc. If the moulder was expected to qualify for the executive positions he should have the necessary educational facilities placed at his disposal. Some three months ago at a meeting at Middlesbrough a very prominent member of the Branch Council, who was in a position to speak authoritatively, said he had never met a moulder who could read a drawing. This was due no doubt because under the present system the only available means resided in technical colleges and schools, and there, with two to three hours per week study, it could not be expected that the moulder would be able to read some of the drawings submitted as inquiries. A sound knowledge of patternmaking, marking off, and general engineering, was essential, and as the moulder was usually quite capable, it was imperative that a further training should be at his disposal. There were obstacles in many ways, owing to long standing customs, but until this question was resolved, there could be much improvement. Very few at school leaving age had any inclination to serve their time, because of the nature of the work. Seldom is an application tendered by the secondary schoolboy, because he sought a more congenial atmosphere than a foundry, usually a black-coated job.

Whilst much had been accomplished in the fields regarding sands, core mixings, and the like, there were still problems very difficult of solution which face the foundrymen, such as tears, cold sheets, blow holes, and so forth. It was difficult to diagnose the cause, or even to put forward a combination of causes. It is in this direction that the Institute should pool its resources, with a view to eliminating these various troubles. The industry could not afford to let these things happen, whilst conducting little or no research as to the cause and the remedy.

The Institute, represented one of the most important and national industries, and the new president felt confident that if an endeavour was made to co-operate wherever possible it would improve the quality and lower the price of its output and thereby be a benefit to all foundry employment therein.

Mr. Swift was accorded a very hearty vote of thanks for his address, on the motion proposed by Mr. Harry Foster, Junior Vice-President, and afterwards entertained the members and visitors to tea.

Mr. J. W. Gardom, Convenor, Technical Committee, then delivered his address on "Some Work of the Technical Committee in Wartime," and his lecture was illustrated with slides. The Paper evoked a most interesting discussion. Mr. W. D. Pugh expressed the appreciation of the meeting for Mr. Gardom's very graphic account of the manner in which certain problems arising from wartime demands had been met and overcome.

Bristol.—The Section opened their winter session on October 10 with a Paper by Mr. J. H. Gale, "Die Sinking and Die Casting," before a good attendance. Arrangement has been made for the presentation of five other Papers during the winter months. The local educational authorities are collaborating with the Section for the provision of tuition in foundry practice.

Scottish.—The Branch had an exceptionally good start to the work of Session 1942-43. The attendance at the first meeting, held in the Royal Technical College, Glasgow, on Saturday, October 10, was easily the largest since the war began, and was almost a record for the Scottish Branch. Following the Presidential Address by Mr. Kirby, reproduced elsewhere, Mr. Vickers and Mr. McDougall read a joint Paper on "Aero Engine Castings (The Production of Light Alloy Castings for the Rolls-Royce Merlin Engine)." The Paper was well illustrated with lantern slides, and was highly appreciated by the members. The President congratulated the lecturers, and thanked them for their services, and the interest they had created in the work of the Branch. Mr. Vickers suitably replied.

FUEL CONSERVATION IN BRASS AND IRON FOUNDRIES*

Practical Means of Saving Fuel in Melting Furnaces, Ladle Heating and Mould and Core Drying Work

By FRANK HUDSON and A. E. McRAE SMITH

A meeting, arranged by the Institute of Fuel, was held in London on July 17, when representatives of all the technical associations throughout the country were addressed by Major Gwilym Lloyd George, M.P., Minister of Fuel and Power. In his remarks, Major Lloyd George stated that he was of the opinion that considerable saving of fuel could be effected in industrial operations, and that it was not always practical to supply a particular type of fuel to meet special needs. He thought much of the modern plant and equipment used was inclined to be too selective in fuel requirements, and an effort should be made by industry to modify plant or method to meet the needs of the present supply position. The Minister of Fuel and Power went on to say that he needed all the help he could get from industry, particularly within the next three months, before the winter peak period arrived.

In this country to-day there are several thousand iron and brass foundries using large quantities of fuel and power, and it should not be difficult for each one of them to effect some measure of saving. The larger foundries with adequate technical control will no doubt have this matter already in hand, but unfortunately these are few in comparison with the number of small jobbing shops who, perhaps, would welcome a little guidance and advice on this most important matter. It is to the latter that the following remarks are principally addressed, although it is hoped that in reading this Paper the larger foundries may also gain some food for thought.

BRASS FOUNDRY MELTING FURNACES

Before commenting on any particular type of melting unit it might be useful to first of all compare general thermal efficiencies. F. W. Rowe has published the data shown in Tables I and II.

C. L. Cassidy[3] and A. Logan[4] have also commented upon the fuel requirements of furnaces used in the brass foundry, and the latter author points out that in the case of the natural-draft pit fire, the coke to metal ratio is poor, ranging from 1:2½ (which can be regarded as good practice) to 1:1½ (which is often the ratio in practice). Taking an overall efficiency, however, of 1:2, the fuel required to melt a ton of gunmetal would be half a ton. With the forced-draft type of furnace the fuel ratio is 1:4½ and even in some cases 1:5. Taking the lower ratio, this would necessitate the use of 4.45 cwts. of coke to melt a ton of gunmetal. In the oil-fired crucible furnace, it takes approximately 28 galls. of oil to raise a ton of gunmetal to the correct pouring temperature. In the case of non-crucible furnaces, as the metal is heated more directly, the oil consumption is less, and can be taken as 22 galls. per ton of gunmetal melted.

TABLE I.—*Furnace Thermal Efficiencies (F. W. Rowe)*[1]

Type of furnace.	Thermal efficiency. Per cent.
Coke-fired crucible pit furnace. Natural draft	3 to 7
Coke-fired crucible tilting furnace. Forced draft	8 to 13
Oil or gas-fired crucible tilting furnace	7 to 18
Reverberatory furnace	12 to 20
Cupola	30 to 40
Small electric furnace	40 to 65
Large electric furnace	60 to 85

TABLE II.—*Cost of Operating Various Types of Coke-Fired Furnaces (F. W. Rowe).*[2]

Operation.	Natural-draft crucible pit furnace	Forced-draft crucible tilting furnace	Half ton reverberatory (Sklenar type).
Total operating time (hours)	9.5	9.0	9.5
Charge weight (lbs.)	160	400	1,120
Melting time (hours)	1.5	1.75	1.25
Casting temperature (deg. C.)	1,200 to 1,250	1,200 to 1,250	1,225 to 1,275
Weight melted per day (lbs.)	960 (6 heats)	2,000 (5 heats)	5,600 (5 heats)
Fuel cost per ton (shillings)	17.5	16.0	12.0
Labour per ton (shillings)	18.5	18.0	11.0
Crucible cost per ton (shillings)	10.5	12.0	—
Electric power, repairs, etc., per ton (shillings)	2.0	2.5	3.0
Depreciation and interest (shillings)	1.25	2.0	3.0
Total cost (shillings)	49.75	50.5	29.0

* Paper read before the London Branch of the Institute of British Foundrymen on October 24, and to be read before other Branches.

Fuel Conservation in Foundries

Generally speaking, it can be concluded that to obtain the most economical fuel consumption in the more common brass-foundry melting operations, particularly as regards coke, it is essential to have plenty of air available for combustion. Accordingly every possible use should be made of forced draft and, when the type of alloy permits, direct fired non-crucible furnaces. A good air supply also provides greater latitude in regard to the type of coke required, as by suitable control of the air, soft or hard coke can be used according to available stocks.

Natural-Draft Coke-Fired Crucible Furnaces

Many furnace installations of this type suffer from lack of draft, and as well as having a very poor thermal efficiency can only be run successfully on supplies of soft coke. The obvious solution to both the above problems is to increase the air supply available as follows:—

(1) Clean out flues (many foundries are careless on this point).

(2) Prevent direct air leakage to chimney or stack by the use of well-fitting refractory furnace covers,* and, if necessary, increase area of air port inlet to firebars.

(3) See that chimney or stack is in good repair (particularly if made of steel) and free from perforations near base. Check area and height of stack to ensure that it is capable of giving the draft required. Increase size of stack if possible or alternatively supply additional air required by the installation of a fan. If the latter method is adopted it may be necessary to enclose pit with steel plates so that a higher air pressure is created at the firebars than at the flue.

The installation of a draft gauge at the stack provides a useful measure of control. The application of auxiliary air by means of a fan should give a very elastic melting unit so far as coke requirements are concerned, as the stack should provide sufficient air for burning soft coke, whilst if harder fuel must be used the fan can be brought into use. If sufficient stack draft is available to handle the harder varieties of coke, the lower air supply required for soft coke can be obtained by reducing the size of the furnace exhaust flues by the insertion of loose firebricks.

Other points which should be kept in mind relative to the operation of all crucible pit-type furnaces in order to obtain maximum fuel economy are outlined below:—

(*a*) Keep lining in good repair and of correct diameter. Use template to check.

(*b*) Use correct size of crucible. Too small or too large a coke space is wasteful.

(*c*) Use correct size of coke.

(*d*) Keep air ports immediately above firebars clear of slag. Many foundrymen are of the opinion that the air supply should enter through the firebars. This is not good practice as the purpose of the coke bed on top of the firebars is primarily to support the crucible. The coke surrounding the crucible provides the heat for melting, and air should be supplied as shown in Fig. 1. Excessive burning of the coke bed which occurs when all the air enters through the firebars is wasteful.

(*e*) Run furnace to full capacity (*e.g.*, do not melt 50 lbs. of metal in a furnace designed to take 100-lb. crucible). Use a preheater top, made from an old crucible, and endeavour to get the whole charge of metal into the furnace at the start whenever possible.

* Iron covers waste fuel through heat losses due to radiation.

Forced-Draft Coke-Fired Crucible Furnaces

Most of the comments previously made obviously also apply to forced-draft crucible furnaces. These units are primarily designed to work with the harder varieties of coke, and if any increase of melting time occurs over a period, it should be ascertained that the fan is delivering the required amount of air and

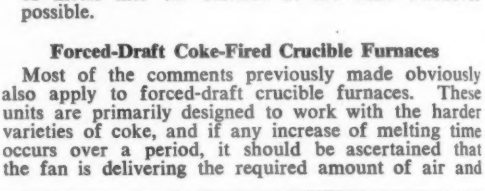

FIG. 1.—SECTION THROUGH NATURAL DRAFT CRUCIBLE FURNACE SHOWING ARRANGEMENT OF FIRE BARS AND AIR PORTS.

The cast-iron firebars B rest upon steel bearer bars and can be slid to one side for removal of clinker. Between the top of the firebars and the bottom of the lining there is a 2-in. gap A. The bulk of the air should enter the furnace through this port, very little coming through the firebars which are closely spaced. This confines the main combustion to the sides of the crucible where it is wanted and prevents the bed coke burning away too rapidly. It is also an advantage to have a deep furnace which will take the whole of the coke required for a heat at one time as well as a crucible fitted with preheater C. Frequent recharging of coke and metal wastes fuel.

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that dampers are working satisfactorily. Many foundries make no effort to control the air supply by means of the dampers, with the result that the latter get jammed with sand, etc., in a partially opened position. Furthermore, indicating devices originally fitted to the dampers get damaged or lost, with the result that the furnacemen become completely befogged as to when the damper is open or shut. This condition is aggravated by the fact that few non-ferrous foundries enforce air control by means of blast or draft gauges. Maximum fuel efficiency cannot be obtained on forced draft furnaces without proper air control, and it is most important that dampers be maintained in good working order, together with clear indication as to the degree of damper opening. Final checking of the air supply should be done with the draft gauge. Such control will also facilitate satisfactory results being obtained with a wider variety of coke which is essential to meet the present supply position.

With forced-draft furnaces, lining wear is much more severe than when natural draft is employed, and it is therefore necessary to patch frequently so as to restore the diameter to the original size as fixed by the furnace manufacturer to give greatest efficiency.

Oil-Fired Crucible Furnaces

Rapid melting in an oxidising atmosphere provides the best conditions for the melting of the majority of non-ferrous alloys, and incidentally gives greatest fuel efficiency. This is not readily obtained from all furnaces, when the trouble will usually be found to be due to the fact that the burner or fan are too small to give complete combustion. In such cases, the remedy is to fit a larger burner and fan. The provision of an adequately sized burner and fan is of particular importance when handling high melting point metals, such as nickel alloys, etc., as large quantities of fuel are often wasted in an attempt to reach temperatures in excess of those for which the furnace has been economically designed. On an open-topped oil-fired crucible furnace a guide to melting conditions can readily be obtained from the colour of the exhaust flame, which should be of a transparent yellow with green edge bordering to yellowish-green. The depth of the greenish tints is roughly proportional to the amount of free oxygen present. A bright yellow or sooty flame denotes incomplete combustion and should be avoided.

A very common source of fuel wastage on oil-fired furnaces is caused by the burner being out of alignment with the combustion chamber, and trouble in this direction can be best avoided by frequent inspection. It is also important that carbon should be prevented from building-up in the combustion chamber, particularly when burning tar or pitch oil.

Larger foundries having the necessary metallurgical assistance available should make more use of exhaust gas analysis in checking fuel efficiencies. It should also be remembered that because a furnace uses more fuel per hr. (after modification has been made), it does not follow that this is being wasted. It may be that due to more complete combustion faster melting is being obtained, and the fuel consumption per pound of metal melted is actually less. Considerable quantities of both coke and oil can also be saved by properly organised melting practice. Even to-day, far too many foundries allow moulders to melt their own metal. This is entirely wrong as the metal is often allowed to remain in the furnace for a longer time than is necessary, which wastes fuel. Melting operations, even in the smallest foundries, should be under the supervision of a reliable man capable of developing the full productive capacity of the furnaces under his control. The elimination of quite minor points, such as shutting a furnace down during the meal hour or bad judgment in connection with molten metal temperatures will, in the aggregate, save fuel.

IRON FOUNDRY MELTING FURNACES

Since the cupola is still the most commonly used melting unit for the production of grey iron castings and accounts for over 90 per cent. of all iron castings produced, it is very important that attention should be given to fuel conservation in this type of furnace. As is the case in the brass foundry, the larger producing units will most likely have adequate technical control to ensure that melting is carried out under the most efficient and economical conditions. This is often not so in the majority of jobbing foundries, which account for a great proportion of the total tonnage of iron castings produced to-day, and the following hints on fuel consumption and conservation are given mainly with the object of assisting the smaller iron foundries. The remarks of course apply to cupolas of all capacities.

Amount of Coke Required for Furnace Bed

Unlike most furnaces the *weight* of coke in the cupola bed does not give a correct idea of its efficiency. The height of the bed above the tuyeres is the important factor, and therefore to maintain a constant height for a given weight of coke, the size of the individual pieces of coke is important. Hard cupola coke usually has a density of 25 to 30 lbs. per cub. ft. If really large pieces of coke are selected or reserved for the bed, then it is obvious that a smaller weight will be required for any given height of coke bed. This selection can easily be carried out by the cupola staff at odd moments, the smaller residual coke being reserved for the melting or "split" coke where a definite weight, as opposed to a definite volume of coke, is required, always provided a minimum thickness of coke layer is ensured in each "split." The ideal thickness of this layer is usually given as 6 in., and if the coke is comparatively small, this will mean a greater weight of coke per "split" to maintain this minimum thickness. In such cases, economy in fuel consumption is still possible, simply by increasing the weight of the metal charge to correspond with the weight of the coke "split."

In making the above recommendations with a view to fuel conservation, it is assumed that the cupola lining

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diameter throughout the well, melting zone and stack will be maintained as nearly constant as possible from day to day by adequate patching or daubing after each melt. When the lining at the melting zone is allowed to become even slightly larger than originally, particularly at the lower end of this zone, a very considerable wastage of fuel in the bed will occur.

It is not recommended that the actual height of the coke bed should be lowered with a view to saving fuel. This would be a false economy and lead to dull metal and loss of man-hours from resulting scrap castings. The first essential in producing good iron castings is to have metal of a sufficiently high temperature. The actual height of the coke bed in any cupola will depend on the type of metal being melted. For ordinary phosphoric cast iron without steel scrap in the charge, it will vary between 24 in. and 30 in. above the centre line of the tuyeres, but for high steel scrap charges and high duty cast irons in general, it must be increased to 36 in. or 48 in., particularly where it is essential that the first metal to be tapped shall be at a high temperature.

Melting Coke Charges or Coke "Splits"

Where melting has to be carried out without adequate control a great deal of coke may be wasted by the use of too large a "split" of coke. The actual melting ratio will depend on the type of metal being melted, and will normally vary from 7 to 1 (*i.e.*, 7 parts of metal to 1 part of coke by weight) to 12 to 1, or even 14 to 1. The greater amount of coke is required when melting high steel scrap, in order to allow for carbon absorption by the steel.

A very good guide for the jobbing foundry as well as for the large repetition foundry is to check up on melting rate. A figure sometimes quoted for normal or average conditions is a melting rate of 20 lbs. of iron per min. per sq. ft. of cupola area at the melting zone. This is equal to 1,200 lbs. or approximately 0.54 tons per hr. This figure is much too low, and the ideal to be aimed at should be at least 28 lbs. per min., equal to 1,680 lbs. or 0.75 tons per hr. per sq. ft. of cupola area. In actual practice, a melting rate about midway between these figures may be considered fairly satisfactory for small blows, but under the best conditions, the higher figure of 0.75 tons per hr. may be exceeded.

If the melting rate in any cupola be found to be less than this, and particularly if the metal is dull, then the weight of the coke "split" should be reduced progressively until a satisfactory melting rate is obtained, coupled with metal tapped at an adequate temperature. Much cupola coke could be saved in this way.

General Hints on Fuel Economy in Cupola Melting

(*a*) The amount of any individual melt should be as large as possible. Small short "blows" should be avoided by regulating moulding operations to suit the melting programme.

(*b*) The cupola should be prepared early in the day, the bed made incandescent as soon as possible and on completion of charging, as long a period as possible should be allowed for soaking the charges to ensure maximum preheating of the initial metal.

(*c*) During melting, the cupola should always be kept full to the level of the charging door.

(*d*) All coke and metal charges should be accurately weighed. Measuring coke by volume (except for the bed coke) is unsatisfactory and often highly wasteful.

(*e*) Adequate steps should be taken to recover as much of the residual bed coke as possible at the end of each "blow." After quenching, the coke should be carefully and thoroughly separated from slag, etc. This coke should be mixed wtih fresh coke and the mixture used towards the latter part of the next day's blow. On no account should it be used for core stove and other types of heating, where softer grades of coke are normally satisfactory.

(*f*) Excessive poking of tuyeres to free them from frozen slag should be discouraged. This leads to loss of efficiency. If it is necessary to clear such slag accumulations in front of tuyeres, then each tuyere should be closed for a few minutes in rotation. This will melt the frozen slag. In the same way, slag holes should be closed up after each slagging operation, and not be left open continuously during the melt.

LADLE HEATING

Many foundries build a coal or coke fire in ladles for re-heating purposes. Large amounts of fuel are consumed in this direction to little purpose. A small fire may be quite useful in drying out a ladle after relining, but this method is not economical for preheating preparatory to filling with molten metal. For the latter operation properly designed preheating equipment, fired by gas or oil, is indicated. If such is not available use a small fire to ensure that the ladle is dry, tap the metal at a slightly higher temperature, or pour the larger castings first when a drop in temperature caused by the use of cold ladles is of little moment.

In some foundries where it is still essential to dry and heat ladles by means of solid fuel, some considerable saving of coke, etc., can be achieved by the use of waste wood. There is often considerable accumulation of very small waste wood available from the foundry patternshop, which is of little value except for furnace lighting and ladle heating.

MOULD AND CORE DRYING

There are still far too many foundry drying stoves operated by open fires, and such methods are highly wasteful of fuel. The most economical method for drying moulds and cores with low-temperature processes is by convection heating, and this forms the basis of modern practice.

W. H. Smith[5] states that fuel consumption with forced-draft furnaces, in relation to the weight of moulds dried, varies according to the size of stoves and conditions of working, but under favourable circumstances 40 lbs. of sand can be dried per lb. of coke consumed.

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In one instance, 46 lbs. of sand per lb. of coke has been recorded. These figures may be a little on the high side. American data[4] published in the FOUNDRY TRADE JOURNAL is reproduced in Table III.

TABLE III.—*Weight of Moulds or Cores Dried Compared with a Given Unit of Fuel Consumption.*

Unit of fuel consumption.	Weight of moulds dried in lbs.	
	Ratio of sand to iron 1 : 1.	Ratio of sand to iron 1 : 2.
Electricity, per kwh.	10 to 15	8 to 10
Gas of 530 B.Th.U. per cu. ft.	1 to 2	0.75 to 1.5
Fuel oil per gall.	400 to 600	300 to 500
Coke per lb.	25 to 40	15 to 25

Naturally, the overall results are affected by a variety of factors, such as weight, shape and section of the mould or cores, kind of sand and matters related to the design and operation of the stove itself.

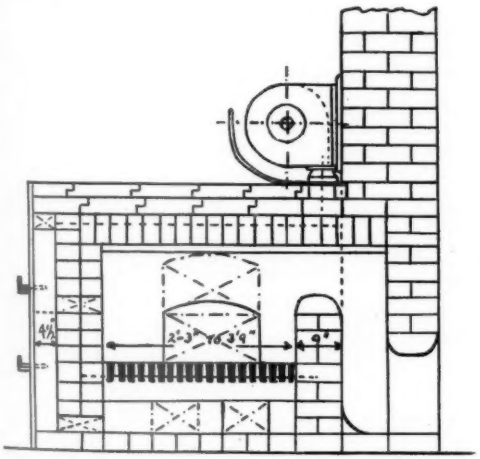


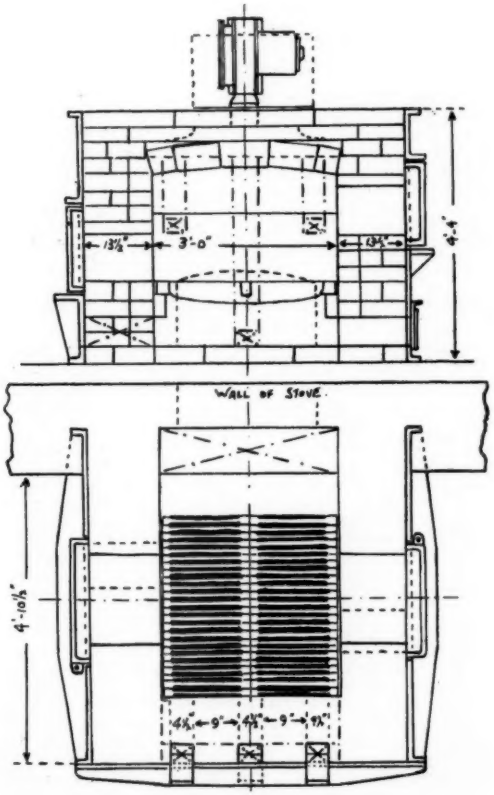
FIG. 2.—HOT AIR FIREBOX FOR FOUNDRY DRYING STOVES.

Firebox suitable for a stove having 3,500-4,500 cub. ft. capacity. Size of firegrate, 3 ft. by 3 ft. Air supplied by 5-in. dia. fan delivering 400 to 500 cub. ft. of air per min. at about 1 to 1½ in. water gauge. (Courtesy of Glenfield & Kennedy, Limited.)

It is not practical to advocate the installation of new stoves at this time, but it is perfectly feasible for those foundries using antiquated drying methods to make certain modifications to existing practice or equipment in order to reduce the quantity of fuel employed. Consideration should be given to the following points:—

(1) Fit a firebox which will circulate hot air in conjunction with suitable inlet and outlet flues for evenly circulating the heat and removing the products of the drying operation. A suitable firebox of the type shown in Fig. 2 can be readily constructed by most foundries.

(2) Use one firebox to two stoves and institute proper drying schedules, *e.g.*, whilst one stove is being fired the other is being loaded up. (Do not allow moulders to open up a hot stove frequently in order to put in or take out moulds or cores.)



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(3) Fit a recording pyrometer so that a check can be kept on temperature and operation.
(4) See that each stove is well filled.
(5) See that doors and walls, etc., are properly insulated.

Open fires or braziers should not be used for drying moulds in the floor. Purchase a modern portable mould drier or make one along similar lines to that shown in Fig. 2. It is to be regretted that far too much use is still made of fire "kettles" and similar appliances for drying large moulds.

As already indicated, it is not practical to recommend the installation of new stoves at this time for the purpose of saving fuel, or even to carry out major alterations and improvements to existing plant. In some cases, however, it would be very easy and practicable to instal some type of automatic feed stoker, using very small coal and other types of fuel not in demand for general purposes. Attention to this should be given, in particular where stoves are still fired by open fireboxes.

Another small point with regard to the drying of cores concerns the use of excessive moisture in wet loam, particularly in cores which have been swept up. Fuel is required to evaporate the whole of the water in such cores, and although very wet loam sometimes makes it easier for the coremaker to carry out delicate operations in the production of the core, this can be grossly overdone. It would be interesting to check up on the amount of fuel used in foundries in Great Britain purely for evaporating this excessive and altogether unnecessary additional moisture.

USE OF COKE IN THE PRODUCTION OF LARGE CORES AND MOULDS

Although it is recognised practice to use only coke ashes and similar material for the centres of large loam cores as well as general venting purposes in cores and core assemblies, undoubtedly a great deal of good soft coke of usable size is employed in this way. Theoretically, all this coke should be recovered during the fettling of the castings or, in the case of ash beds for large moulds, the coke would be recovered each time the bed is reconstructed. In actual practice, this is not the case, and if any iron foundry cared to make a careful record of the coke used against the coke recovered in these processes, they would be somewhat alarmed at the actual fuel wastage. Even for a very small foundry, it is no exaggeration to say that this may reach a figure of 40 to 50 tons of coke per year.

Every foundry manager should use his ingenuity to prevent the use of raw coke for these applications, and in the case of very large loam cores, the centres are often filled completely with raw coke. These spaces can, in most cases, be left quite open. Where crushed raw coke is to be used for filling vent tracks, etc., porous material like blown crushed slag might be suggested as an alternative.

Finally, where no other substitute can be found and it is considered really necessary to use raw coke, very definite instructions should be given that this is recovered completely and subsequently used as fuel.

GENERAL

Electric power consumed for lighting purposes is a large item in these days, and admittedly it is difficult to utilise daylight as so many foundries have fitted permanent blackout. It might, however, be possible to save some electric power if occasional attention were given to the fitting or cleaning of reflectors. Very few foundries pay attention to this point, and allow lamps and reflectors to become covered with dust and grime so that a 500-watt bulb gives the light of 400 watt. Try considering the possibility of utilising lower-powered lamps fitted with reflectors and keep them clean. The results may be surprising both as regards the amount of light obtained and electric power saved. Alternatively, explore the more economical methods of lighting which have been developed in recent years.

Far too many foundries allow the use of open braziers intended for general heating purposes, but mainly used for boiling water for making tea. It is much more economical to instal proper heating methods or slow combustion stoves and provide a gas boiler for hot water supplies if no canteen facilities are available. Particular attention should be given to remedying all leaks in the compressed air supply. Quite a small escape of air runs away with a large amount of fuel and power.

Finally, institute and maintain a comparative record of the amounts of the various forms of fuel and power consumed so that wastage may be checked and the necessary economies definitely effected. If the size of plant permits, or if technical control is available, put a man in charge of fuel conservation, give him a copy of this article, and tell him to get on with the job.

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Scrap from Slag Dumps

In June the Carnegie-Illinois Steel Corporation recovered 4,825 tons of scrap from its slag dumps. It is hoped to recover annually upwards of 50,000 tons of scrap from such "mining" operations. The reclaimed scrap must meet specifications, and is paid for on a tonnage basis. It is not only mined by outside contractors, but is prepared and delivered by them. The slag reclaimed consists largely of "skulls." At the time this metal was worked, it was dumped because it was too expensive to recover when compared with the cost of scrap prevailing at that time.

MEETING THE DECLINE IN CRAFTSMANSHIP

SCOTTISH BRANCH PRESIDENTIAL ADDRESS

On his induction to the chair of the Scottish Branch of the Institute of British Foundrymen, Mr. Kirby addressed the members on the subject of the decline in foundry craftsmanship. In the course of his remarks, Mr. Kirby said that there was a deterioration in craftsmanship during recent years, which was undeniable. Associated with this was the question of improved methods of apprentice training. This very vital matter had only been dealt with in a very lukewarm manner. Apart from a few isolated instances of firms, which were giving their foundry apprentices an opportunity to improve their knowledge of foundry technique, very little had been done in the way of preparing apprentices as the future craftsmen of the industry.

Speaking as a practical foundryman, it was appalling to him to encounter so many young men and boys, who appeared to display no interest in their craft at all. Elementary fundamentals of founding were "Greek" to some of them, when questioned as to the "why and wherefore" of certain foundry practices.

Why did such a state of affairs exist, or rather, how much longer was the industry going to allow such an undesirable state of affairs to continue? One could lay the blame upon lack of interest, or carelessness on the part of the youth of to-day. No doubt there was a great deal of this spirit existing, but he felt inclined to take a more sympathetic and tolerant view, honestly believing that at least some of the blame for their shortcomings lay elsewhere than at their own doors. It could, of course, be pointed out that ample facilities were offered to any boy to attend evening classes, if he was really desirous of improving himself in life; yet sight must not be lost of the fact that, whereas the more mature would have looked upon similar opportunities in their youth as a wonderful boon, there was to-day quite a different spirit abroad; a desire, and opportunities provided, for entertainment unknown in those days.

He had no desire to defend the youth of to-day in all their tendencies, and he agreed that anything worth while obtaining was all the more appreciated if it had to be fought for, or if sacrifices had been made in its achievement. Neither was he prepared to condemn them out of hand if they failed to take advantage of the facilities offered them at the present time.

What he was mainly concerned about was the welfare of the industry as a whole, and if present-day methods of education were not taken advantage of, then some other method should be tried, to improve the standing of the foundry industry.

If the young moulder demanded that his spare time time be allowed him for his pleasure, that to some extent was his own concern, but unless some alternative method was undertaken to improve his knowledge of foundry technique, it would eventually sound the death-knell of the foundry industry as well.

The Scheme Outlined

Maybe the following suggestions would be classed as idealistic and impracticable. The main objection, if any, would no doubt be financial considerations. Bearing this and other possible objections in mind, he still believed, after mature consideration, that some such scheme as he proposed to suggest would, in the fullness of time, be forced into operation.

A few years ago, the Government decreed that the school-leaving age be raised to sixteen years of age. This compulsory measure had been suspended for the duration of the war. It was very probable that the Act would be put into operation after hostilities ceased. He did not wish to be misunderstood when he said he sincerely hoped that some means would be found to prevent this happening.

No one was more sincere in his desire to give every boy his chance of a good education than himself, but he would prefer that the education be given on less stereotyped lines than the usual graduation from council school to higher grade school. Given a boy leaving school at fourteen years of age, the new President said he would guarantee that he would make a better craftsman than would be possible if he went to a secondary school until he was sixteen years of age and then entered the foundry. It is very doubtful, if he went to a secondary school, whether he would even condescend to work in the foundry, but, assuming he agreed to do so, the nature of his studies at the secondary school would have so prepared his mind that founding would have very little, if any, attraction for him. It was far better to start the boy in the foundry at his most receptive age, and incorporate a system of compulsory technical training, in conjunction with his practical training, over a period of seven full years' apprenticeship.

What was there to prevent technical colleges being utilised, or being built, if sufficient were not available whereby every boy in the industry could be sent for a specified period every year for technical training. Seeing that the training would be compulsory, the boy would receive his wages, plus necessary travelling expense. The cost of this could be arranged so that part of the expense would be borne by the industry and part by the Government.

He was aware that a considerable sum of money would be needed to finance a scheme such as this, but he was fully convinced that, given the will to promote something on these lines, the money could be found, and would prove a real sound investment both for the industry and the country generally.

Beneficial Results of Scheme

A tremendous improvement in craftsmanship would be seen in a few years' time, with consequential benefits in all directions. A more desirable type of boy would be attracted to the foundry, and the industry would soon be in possession of potential executives, reared in their own shops, and in possession of a thorough practical and technical training—the practical part being a very decided asset.

It was obviously impossible to go into details of such a scheme, but he suggested that arrangements

Meeting the Decline in Craftsmanship

could be made whereby three months out of every year could be devoted to technical training. Every apprentice would be called upon to attend these classes for three or even four years. At the end of this period, those responsible would be in a position to determine whether it was desirable for any particular apprentice to continue his studies or not.

If it was thought that continuation would not be beneficial, the apprentice would of necessity be compelled to serve the remainder of his apprenticeship entirely in the foundry. All could not become managers or foremen, but even those who were unable to qualify for executive positions would have obtained inestimable benefits from even this limited association with the technical side of the industry, and there could be no doubt that this would be reflected in a much higher standard of craftsmanship as time passed along.

For those boys who showed marked ability, the way would be open to continue their studies up to the conclusion of their apprenticeship, all the time, of course, combining their studies with periods of practical training. Careful records of their progress would be kept, and opportunities offered in every way, to enable them to qualify for executive positions. After having had an equal opportunity for three or four years to show his worth, it should then be an easy task to select, entirely on merit, those most deserving of advancement. The selection need not necessarily be made solely on examinations, but rather judged by general progress both at school and work, because an examination result by itself was not always a reliable guide as to a student's real abilities.

Many difficulties would no doubt arise in such a scheme, the most probable one being that one particular firm might have a very large percentage of really brilliant boys, whilst another firm would find that none of their apprentices was sufficiently competent to continue his studies. The answer to this must be that, no matter where the boy came from, he should be allowed the chance to develop his talents and, seeing that it would be in the interests of the industry as a whole for him to do so, it was only logical that the employers' portion of the cost should be pooled.

Many other objections could no doubt be put forward, but one thing was certain, and that was that reform was needed, and urgently needed, in this particular aspect of foundry planning. Much has been accomplished in the way of mechanising present-day foundries, with a consequent diminution in the number of skilled operatives required, but it must not be thought (although the tendency is to enlarge the scope of mechanisation in the foundry) that the industry could afford to neglect any longer the question of personnel, either operative or executive.

Ten thousand tons of nickel will be conserved this year by the Westinghouse Electric & Manufacturing Company through the substitution of Hipersil steel for a nickel alloy in electronic equipment.

ENAMELLING RESEARCH AT MELLON INSTITUTE

In the annual report of the Mellon Institute, Pittsburgh, Pa., for the year to February 28, 1942, reference is made to research at the institution relating to cast-iron enamelling and hollow-ware enamelling. D. G. Bennett has been engaging on numerous problems involved in the dry-process enamelling of cast iron. The composition of pig-iron has been given searching scrutiny, as have the clays of importance in keeping a cupola in continuous operation. Iron, as cast, has been investigated as to constitution and inclusions by chemical and spectrographic methods, while comprehensive physical tests have been carried out. With the development of bathroom fixtures of increasing usefulness and beauty, considerable effort must be devoted to making sure of their durability under extreme conditions of service. As indicated, the cast iron, the foundation material of a fixture, has been studied from every point of view.

A very high degree of adherence of the enamel to the metal is essential. As this property is hidden, success in attaining it is indicated where the enamelled ware user is practically unaware such a problem exists. Test methods have been worked out that aid in the development of adherence to a high degree with a concomitant decrease in the probability of enamel failure. The porcelain enamel itself has been and is being investigated from the standpoint of its proper fit to the metal, body and surface hardness, resistance to chemical reagents, reflectance, and opacity.

E. E. Marbaker has worked on problems incident to the adaptation of the Hommelaya (two coat-one fire) process to the enamelling of hollow ware, and the investigation of raw materials, such as clays of domestic origin; a definitive comparison of a number of enamel clays has been made. Determinations have been concluded on the effects of these clays in a standard ground coat formula on setting power, measured by the weight of enamel adhering to bare pickled and to ground-coated steel plates, and on viscosity. The results, which serve as a basis of appraisal and classification of the clays, have led to an inquiry into the action of varying amounts of setting agents on the properties of slips in which the clays are used.

SPUN BOMBS

Bomb production by a new spinning method is announced by the National Tube Company, a United States Steel Corporation subsidiary. The process is being utilised by the Army Ordnance Department. In the new process a pre-heated steel tube, turned at a high rate of speed, is fashioned quickly and with surprising precision into the nose and main body of a bomb by a huge arm which swings into position and moulds the revolving tube into the desired shape. Other machines, by the same method, shape the tail portion of the main bomb body. Bombs of various sizes are made by this method, and after they leave the spinning machines they are normalised, finished, threaded, have carrying lugs welded on, are painted and sent to loading plants.

THE DRYING OUT OF SYNTHETIC SANDS*

By N. J. DUNBECK

Effect of Various Drying Agents on Characteristics and Rate of Drying-out of Naturally-bonded and Synthetic Sand Mixtures is Studied

Synthetic sands are those made in a foundry, as required, from materials so selected by the foundryman as to best fit his particular needs. The silt and fines in naturally-bonded sands have a large surface area and require a substantial amount of tempering water to wet the surface and make them mouldable. The clay in naturally-bonded sands is usually less efficient than specially-selected bond clays, and a relatively large amount of tempering water is necessary to wet and make plastic this substantial amount of clay.

In contrast, synthetic sands contain a small amount of strong clay and a minimum amount of fines. Less tempering water is required and a higher permeability results. Tempering water seems to be evaporated faster from such an open sand, and it is believed that the loss is more apparent and more of a problem due to the small amount of water present. For example, if a synthetic sand containing 4 per cent. water and naturally-bonded sand containing 7 per cent. water each lose 1 per cent. water by evaporation on a hot day, the synthetic sand loss is one-quarter while the naturally-bonded sand loss is only one-seventh.

Current Remedies

In present practice, synthetic sand is tempered heavier on hot days and allowance thus is made for the probable evaporation before use. The wide use of synthetic sand is evidence that this is a satisfactory method of producing castings, but it would be very desirable to reduce the moisture loss in both naturally-bonded and synthetic sands. Glycerine has been successfully used, but is expensive. Fuel or crude oil is also in use. Usual addition of such oils is about 1 gall. per ton of sand, the oil being added only a short time before the mixer is dumped. Oil also may be dripped slowly on to a system sand on a conveyor belt before it reaches a mixer of any type. The use of fuel oil in this manner, in a large malleable foundry, not only has eliminated previous complaints from the moulders, but has permitted an actual reduction of 0.75 per cent. in tempering water added, with satisfactory "feel" of the sand maintained. It is claimed that the oil has a slight lubricating effect on the pattern and that less sticking of hot sand and less cleaning of pattern is required. It also has permitted a substantial reduction in the amount of coal dust used. Presumably the fuel oil gives off a gas with similar action to that evolved from coal dust.

The use of fuel oil ordinarily would be expected to result in somewhat lower strength. Within the normal moisture range, synthetic sands become stronger as moisture is decreased. In the particular case mentioned, the reduction in moisture content more than compensated for any strength loss due to the oil addition. In other foundries, the addition of oil is said to have required the use of more bond clay. The one and principal objection to the use of fuel oil is the annoying smoke which is created on pouring. This is of sufficient nuisance that it almost prohibits the use of oil in floor shops. The smoke is of no consequence when the castings cool on a covered mould conveyor.

Experimental Work

Any steps toward the solution of the problem of drying out of synthetic sands were of evident value, so work on the matter was included in a research project sponsored at Battelle Memorial Institute, Columbus, Ohio, by the company with which the writer is associated. In this project, it was decided to measure the effect of chemical and physical agents which lower the vapour pressure of water. Such agents might be expected to give the maximum reduction in the drying rate of synthetic sands.

Since temperature and humidity have a great effect upon the rate of drying-out, all mixing and testing was performed in a room which was maintained at 77 deg. F. and 55 per cent. humidity. Unless otherwise indicated, all treating agents were added in solution in the tempering water. All additions were by percentage of the weight of clay in the mixture. All testing was done in accordance with A.F.A. standards. Ten specimens of each sand were weighed immediately after mixing and exposed on an enamelled plate. All surfaces except the bottom were exposed. The drying of such a specimen would be more rapid than sand in a heap or facing box. The test can be considered, therefore, to be an accelerated one, but comparable from one mixture to another. The samples were reweighed at intervals and the loss expressed as the percentage of the original moisture content which was lost during drying.

Effect of Agents Used on Bentonite and Fireclay-Bonded Sands

Table I shows that some materials were effective in reducing the drying-out of southern-bentonite-bonded sand during short periods. If the problem was the drying-out of facing sands, it seems likely that agents should be selected which offered the greatest decrease in drying-out over short periods of time. Among the most effective of these were lithium chloride, zinc chloride, ethylene glycol and dextrin. If the problem was the drying-out of system or heap sand, lithium

* Extracted from a Paper read before the Cleveland Convention of the American Foundrymen's Association.

Drying Out of Synthetic Sands

chloride is indicated as the most effective over long periods of time.

Further work showed that most treating agents were more effective on fireclay-bonded sands than on southern-bentonite-bonded sands, which leads to the belief that different treating agents should be used, dependent on the type of bond in use. Lithium chloride, zinc chloride, cereal binder No. 1 and ethylene glycol were most effective, lithium chloride being the most effective. This was particularly true over long drying periods.

Another series of tests indicated that western-bentonite-bonded sands dried out more slowly than southern-bentonite- or fireclay-bonded sands. Most treating agents were not effective on western bentonite and only lithium chloride gave an appreciable reduction in the rate of drying-out. Lithium-chloride additions to southern-bentonite-bonded sands are worthwhile, with calcium chloride and barium chloride effective to a lesser extent; both lithium chloride and calcium chloride are very effective on fireclay-bonded sands. Again, lithium-chloride and calcium-chloride additions, when applied to western-bentonite-bonded sands, are of value.

TABLE I.—*Effect of Various Agents on Southern-Bentonite-Bonded Sand.*

Agent added.	Per cent. added.	Moisture loss, per cent. Time, min. 30	60	90	120	180	360
None (blank)	—	6.1	10.0	13.9	16.6	22.1	31.9
Lithium chloride	0.5	6.3	9.7	13.6	16.3	21.9	31.6
	2.0	5.5	9.2	11.2	15.2	19.6	27.8
	5.0	5.0	8.6	11.2	13.6	17.5	24.0
Potassium acetate	0.5	5.6	9.6	12.7	15.5	20.6	29.1
	2.0	5.9	10.2	13.3	15.9	20.7	29.2
	5.0	5.8	9.4	12.4	15.2	19.9	28.2
Zinc chloride	2.0	5.7	8.8	10.8	13.4	16.2	31.0
	5.0	5.3	8.8	11.2	12.8	16.5	31.0
Cereal binder No. 1	2.0	5.9	8.7	11.5	11.5	18.3	33.0
	5.0	6.0	10.0	11.4	12.3	18.1	33.2
Ethylene glycol	5.0	5.4	9.5	12.9	16.6	20.0	32.7
Sulphuric acid	5.0	4.5	8.7	12.0	15.1	19.9	33.4
Phosphoric acid	5.0	4.7	8.3	10.7	14.1	17.9	28.9
Dextrin*	5.0	4.2	8.8	11.9	15.0	19·9	31.5

* Added dry to the clay sand mixture.

Effect of Lithium and Calcium Chlorides on Properties

Calcium chloride had little effect on the mechanical properties of a southern-bentonite-bonded sand. Previous work has shown, however, that calcium chloride is less effective than lithium chloride. A 10 per cent. addition of lithium chloride to the southern-bentonite-bonded sand caused a drop in both green and dry strength. Smaller additions, which were effective in reducing the drying rate, had no material effect on strength. The green strength of the fireclay-bonded sand was not materially affected by any additions of these chlorides. Two per cent. calcium chloride had little effect on dry strength, while larger additions substantially increased this value. This would be desirable in some applications and undesirable in others.

Lithium chloride, which was most effective in reducing the drying rate, caused a substantial drop in hot strength of the southern-bentonite-bonded sand and a lesser drop in the fireclay-bonded sand. Calcium chloride also caused some drop in hot strength of both sands.

TABLE II.—*Rate of Drying of Commercial Synthetic Sands to which Oil is Added.*

Sand.	Moisture loss, per cent. Time, min. 30	60	90	120	180	390
System sand—5 gal. fuel oil added per ton	2.9	5.6	7.9	11.3	14.3	27.4
Facing sand—made from system sand plus 5 quarts of fuel oil	2.9	5.2	6.8	8.8	12.4	23.4

Drying Out of Synthetic Sands

Cereal binders were effective in reducing the rate of drying-out of fireclay- and southern-bentonite-bonded sand, but less effective with western-bentonite-bonded sand. Sucrose was effective only with the fireclay and the sulphite binder was particularly effective with fireclay. It also will be noted that small additions of calcium and lithium chloride reduced the drying rate of the fireclay-bonded sand as much as very large additions of cereal binder.

Drying-out Behaviour of Naturally-Bonded and Synthetic Sands

At this point in the investigation, it was apparent that the drying rate could be reduced, and it was necessary to determine how much improvement was needed to provide a satisfactory sand. Naturally-bonded sands, and also synthetic sands, treated with oil had been declared to be satisfactory by users. Therefore, their drying behaviour was determined. The percentage moisture loss in naturally-bonded sands is lower than with synthetic sands, though the actual moisture loss is as great or greater. It seems, therefore, that these naturally-bonded sands do not dry out slower than synthetic sands, but that the loss is less important because they are workable over a wider moisture range. This is true also of fireclay-bonded sands which give less trouble from drying-out in the foundry than the bentonites, although the rate of moisture loss is greater in the fireclay-bonded sands.

Effect of Fuel-Oil Additions on Drying-out

Fuel oil, added a short time before the mixer was dumped, had little effect in reducing the rate of drying-out. It was found that check results were more consistently obtained in all tests in the periods of longer drying, and it is suggested that comparisons between tests be made on such basis. The system sand in Table II is composed principally of burned core sand, with a small amount of bank sand and coal dust; the clay used was a combination of one-half fireclay and one-half southern bentonite. There were 60 tons of sand in the system, which was used three times per hour. Therefore, the 5 galls. of fuel oil per hr. was added to 180 tons of sand. Since not all of it was burned out, there must be a substantial reserve of oil in the sand at all times. The foundry found a definite improvement from the addition of the 5 qts. of fuel oil to the facing sand. This reduced the 390 min. drying-out from 27.4 per cent. to 23.4 per cent., which gives some measure of what constitutes an appreciable improvement.

Steel-foundry sands have a lower rate of loss than malleable or naturally-bonded sands, despite their high permeability. This is due possibly to the cereal binder in the mixture. Malleable facing sand was satisfactory in use when the moisture loss was 23.4 per cent. in 390 min., which meant that it was losing water at about the same rate as the naturally-bonded sands. Since the first three synthetic sands lost from 27.7 to 34.4 per cent. moisture, it might be assumed that a substantial improvement is necessary. This does not take into account the fact that the original synthetic sands were made from silica sand and bond only, with no fines present, as is the case in a regularly used synthetic sand. Therefore, the condition is exaggerated and the test a severe one. It seems likely that the presence of fines would reduce the rate of drying-out about 5 per cent. and that only a further reduction of 5 per cent. would be required. Many of the treating agents used accomplished this quite easily.

Summary

The results of this investigation may be summarised as follows:—

(1) Several addition agents were used which appreciably reduced the rate of drying-out of synthetic sands.

(2) A comparatively small reduction in the rate of drying-out is of appreciable benefit.

(3) Naturally-bonded sands lost more water in any particular time, but the percentage of moisture loss was lower than for synthetic sands because of the higher quantity originally present.

(4) Fuel-oil additions did not appreciably reduce the rate of drying-out in experimental work, but are of value in commercial use. Sands treated with fuel oil felt wetter than was actually the case and were more workable. Since the chief disadvantage of dry sand is that it is brittle, oil additions may be of value in that they increase resilience and workability.

SCALING IN ALLOY STEELS

To compare the results of scaling tests it is very desirable to employ standard methods of test, suggest G. BANDEL and K. E. VOLK in the "Archiv für das Eisenhüttenwesen," who analyse the fundamental laws of scaling in alloy steels and the requirements which must be met in practice. The aim of such tests should be to provide numerical data of the scaling propensities in relation to the time of heating, the temperatures, etc., from which the life and hence the behaviour of a material in service can be estimated. From a survey of the various methods available and a comparison of their advantages and disadvantages in the light of their suitability for a simple technological serial test, the authors recommend the determination of the loss in weight as best. Information is also given of the choice of shape, surface and exposure of the samples tested, the best type of furnace for tests in different gases, molten salts and metals, the time of heating required and intermediate coolings as well as various descaling methods. A recommendation is made to use samples of 5 × 25 × 50 mm., which should be heated for 120 hrs. with daily intercools. The descaling method recommended is that using ammonium citrate, or in special cases KCN-soda. Loss in weight should be stated in grm. per hr. per sq. m. The sources of error and reproducibility of this procedure are discussed, as well as the evaluation of the experimental results, especially the possibility of extrapolating to long periods of heating and fixing the upper temperature for use of a material in service.

MANGANESE-SULPHUR BALANCE IN OPEN-HEARTH PRACTICE

In a Paper which Mr. L. S. Darken and Mr. B. M. Larsen presented to the American Institute of Mining and Metallurgy, bearing the title of "The Distribution of Manganese and of Sulphur between Slag and Metal," the authors have summarised their conclusions in the following statement:—

It has been possible to express quantitatively and with satisfactory accuracy the distribution of manganese and of sulphur between liquid metal and slag in the basic open-hearth furnace over a wide range of slag composition. The distribution ratio at equilibrium depends upon concentration factors that are directly determinable from the chemical composition of slag and metal, in the case of sulphur involving also three constants that have been evaluated from laboratory determinations of equilibrium between liquid iron and simple slags. This leads to the following practical conclusions with respect to the conservation of manganese and the elimination of sulphur in making basic open-hearth steel.

Retention of manganese in the steel is favoured by a high concentration in the slag of MnO relative to FeO, which implies that maximum retention is obtained where the slag is basic enough, or rich enough in lime, to liberate essentially all the MnO from complex silicates, yet not so basic as to have an increased concentration of FeO and the associated increase in slag volume. The optimum slag composition for maximum retention of manganese is one corresponding to an effective lime-silica (basicity) ratio between 2.3 and 2.5.

A high distribution (concentration) ratio of sulphur in slag to sulphur in metal is favoured by: (1) High concentration of effective or "free" CaO and MnO in solution in the slag; (2) low concentration of FeO in the slag; and (3) low concentration of SiO_2 and P_2O_5 in the slag, such as to favour a large total number of molecules (N_s) per unit weight of slag; or, in other words, to bring to a minimum the number of large silicate and phosphate compound molecules present in the liquid slag.

The foregoing statements apply to concentration relationships, but the amount of slag present per unit weight of steel is in practice also a factor. With respect to maximum recovery of manganese in the metal, the requirement is simply minimum slag volume, and this presumably is dependent upon the practical minimum of silicon in the charge, with lime adjusted thereto so that the 2.3 to 2.5 lime-silica ratio is obtained. Good sulphur retention in the slag is also consistent with such a low slag volume up to a certain point, in so far as it can be promoted by a low-silicon, high-manganese charge; but if still better elimination of sulphur is required, or if the charge is high in silicon, more lime must be added, with a consequent increase in slag volume and a resultant decrease in manganese recovery.

The satisfactory agreement between data from a large number of open-hearth heats, covering a wide range of slag composition, and the equation, which is based on certain simplifying assumptions, corroborates the validity of these assumptions and leads to the following conclusions regarding the constitution of the slag and metal.

In the metal substantially all the sulphur can be regarded as being present as FeS; less than 5 per cent. as MnS.

In a slag for which the lime-silica (basicity) ratio has a value greater than about 2.0, substantially all the MnO and FeO are "free" instead of being combined with other oxides to form less simple compounds. In these same slags, lime and silica are combined to form the very stable dicalcium silicate ($2CaO.SiO_2$), which at steelmaking temperatures is not dissociated to any appreciable extent.

Lime present in excess of that required to form the dicalcium silicate is available for the compound $3CaO.SiO_2$, which, however, dissociates much more than the disilicate.

In less basic slags both MnO and FeO replace lime in $2CaO.SiO_2$ to some extent, MnO apparently being somewhat more active in this respect.

The compounds calcium sulphate and calcium ferrite, which are continuously formed to some extent at the upper slag surface, appear to be dissociated to a much greater extent at the slag-metal interface. Thus, these act as oxygen carriers downward through the slag; the most important can be regarded as ferric oxide, the concentration of which relative to ferrous oxide is decidedly less at the bottom than at the top of the slag layer. The activity of oxygen at the interface seems to be closely approximated by assuming that it is equivalent to the total oxygen in both ferrous and ferric oxide, as determined by analysis, even though the ferric oxide may not be completely reduced at the interface.

NEW GERMAN ZINC SPECIFICATIONS

New standard specifications for zinc alloys have been fixed by the German army supply organisation. These provide that for all general orders one of five grades must be used. All include 99.99 per cent. Zn, and 0.075 per cent. of Fe, 0.001 per cent. of Sn, 0.008-0.011 per cent. of Pb and Cd, and 0.005-0.010 per cent. of Bi, etc., are tolerated. The all-purpose zinc alloy for castings contains 3.5-4.3 per cent. of Al and 0.01-0.05 per cent. of Mg. Cu contents are limited to 0.6 per cent. max. for die castings, with the proviso that as little copper as possible is to be used. For other castings, for rods, profiles, tubes, pressings 0.5-1.0 per cent. of Cu are specified. Alloys containing 0.7-0.9 per cent. of Al and 0.3-0.5 per cent. of Cu are suggested for two uses. One grade which also contains 0.01-0.05 per cent. of Mg is to be used for die, sand and chilled castings where compatibility with solders is important. The same alloy, but without Mg, is specified for wire, especially for electrical purposes. The fifth Zn alloy contains up to 0.2 per cent. of Al, 0.8-1.2 per cent. of Cu, and up to 0.005 per cent. of Mg. It is specified for sheets and strip, especially for drawings.

MAKING BEND-PIPE CORE FROM MOULD

By W. GUDGEON

The core-mould and core, the making of which is described below, is for a bend-pipe for a circular water main, the core when completed measuring 12 ft. long by 12 in. diameter. Twelve of these cores were required, and the question of production costs demanded a departure from the usual method of making them in halves, in which case two new core irons would

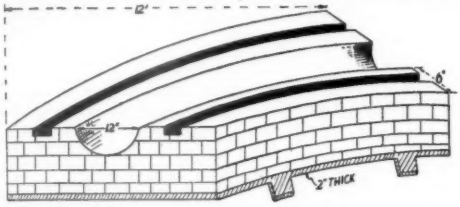


FIG 1.

FIG 2.

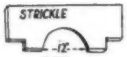


FIG 3.

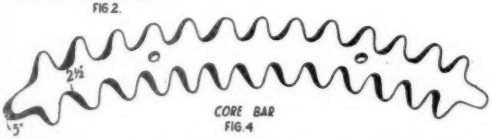


FIG 4

have been necessary for every core, besides jointing and bolting the two halves together, which operation could only be carried out by the use of the crane. With this in mind it was decided to make the core in the following way:

A plate, taking the shape of the pipe, was marked out by the aid of a central spindle and board, the plate being 2 in. thick and cast open sand. Two or three courses of bricks were then laid on the plate, and on top of these half a mould was swept up with loam, again using the spindle and board with strickle attached, the finished core-mould being shown at Fig. 1. It will be noticed that two channels run parallel with the mould, one on each side. The two guide pieces shown in Fig. 2 fit in these channels for the purpose of keeping the strickle in place when forming the top half of the core. The pieces stand up half an inch above the joint and the cut-out parts of the strickle (Fig. 3) rest on the guides. The core iron or bar (Fig. 4) is cast open sand and combines rigidity with strength, a very necessary combination as there must be no sagging of the core when it is lifted out of the mould. Two ¾ in. nuts are cast half way in the bar for the purpose of lifting the core with ring screws. No irons are necessary to reinforce the top half of the core, and the same bar will do for any number of castings. It measures 5 in. thick by 2½ in. broad.

The core is made of oil sand, of which a layer about 1 in. deep is spread on the sides and bottom of the mould. The core bar is given a coating of clay wash and lowered on to the oil sand, and the bar is then tapped lightly down, so giving it a firm bedding on to the sand. More sand is then added and rammed tightly round the bar until half of the core is completed. At this stage iron packing is built up in two places on the core bar so as to come level with the top of the core. These packings contact the chaplets, which hold down the core while the metal is being poured. A track of fine ashes about half an inch diameter is laid along the centre for the escape of air and gases, the ashes showing at each end of the core. The ashes also act as a medium for the release of moisture in the process of drying. The top half of the core is then rammed and the surplus sand strickled off. The mould, with the core still in it, is then put in the stove to dry. After drying and while still hot the core is hoisted from the mould and given a coat of blacking or plumbago, after which it is allowed to dry out.

No difficulty is experienced in removing the core bar from the casting, as rapping it with a heavy hammer while it is slung in the crane causes the burnt oil sand and ashes to run out, the core bar slipping from the casting by its own weight. If two core irons, bolted together, were used, to release them from the casting would necessitate breaking them. It will be seen that a substantial saving in time and material was effected by this method, with the added advantage of producing a perfectly round core.

AMERICAN FOUNDRY ACCIDENT RATE

According to the annual statistical report issued by the National Safety Council, Chicago, the 1941 accident experience of the American foundry industry was the worst since 1926. An increase of 31 per cent. in the frequency rate or the number of reportable injuries per million hours of exposure raised the average rate of the industry to 21.27. This rate was 38 per cent. above the average for all industries, for which average increase in frequency was only 8 per cent.

The 1941 severity rate, or number of days lost as a result of reportable injuries per 1,000 man-hrs. of exposure, showed an increase of 20 per cent. in 1941 as compared with a general industrial decrease of 8 per cent. The foundry severity rate was 1.33 days of disability by 1,000 man-hrs. worked. Steelfoundries had the highest 1941 injury rate, averaging 35.80 for frequency and 1.98 for severity.

The Aluminum Company of America, Los Angeles, holds the best known all-time no injury record in the industry of 2,034,419 man-hrs. Increases in injury rates were especially large in the biggest foundries, averaging 34 per cent. for frequency and 26 per cent. for severity. This is explained by the fact that expansion in operations was larger in the big foundries, according to man-hours worked.

SCATTER IN HARDNESS TESTS

In view of the limited information on the scatter in hardness values obtained in the various standard hardness-testing methods for steel, and to investigate the limits in this scatter which must be taken into consideration for the more accurate conversion of hardness values from one scale to another, some work has been carried out in Germany under the auspices of the materials sub-committee of the Verein deutscher Eisenhüttenleute, which are outlined in Report No. 584 of the sub-committee by W. HENGEMÜHLE, reprinted in "Stahl und Eisen" of April 16 last. It is pointed out that even with the most careful testing technique errors are unavoidable in Brinell, Vickers and Rockwell hardness tests, owing to the inherent irregularities in the shapes of the indentors and to unavoidable errors in the loading and reading of the testing machines used. Discussing the sources and nature of these errors, the author reports on experiments designed to measure the magnitude of these errors, which have been plotted and from which the minimum scatter obtainable by the different hardness-testing methods can be calculated. Some practical examples are given of the application of this new method of scatter-range measurement to the mutual conversion of Brinell, Vickers and Rockwell hardness values taking into consideration the inherent errors of these different tests. Conversion curves are given as well as a comprehensive table showing the minimum scatter in Vickers, Brinell and Rockwell-C values for different loads and ball diameters. The author emphasises the need for further comprehensive research on this subject, his report being only of a preliminary nature. The investigations desirable are too much for one laboratory to carry out, and a co-operative scheme is recommended.

SWARF DISPOSAL

Industrial Utilities (Birmingham), Limited, of Lombard House, Birmingham, have designed and marketed a range of machines for the efficient disposal of swarf associated with maximum oil recovery and reduction of handling labour. For de-oiling, the swarf is passed by means of a plate belt conveyor by looping through a hot water bath of a double compartment variety where the temperature is maintained at 100 deg. F. This bath is agitated and a floating pipe connected to a pump takes off the oil. Leaving the bath the conveyor climbs and during its passage the swarf is subjected to a thorough cleaning by sprays. The oil is further treated by centrifuging and is ready for re-use. At the end of the conveyor the swarf drops down a shute to fill either a truck or lorry for baling or processing for re-use.

Cast Iron in Unit Heaters.—Cast-iron heating sections have replaced those of aluminium in the Grid unit heater manufactured by a Wisconsin firm. The unit is engineered along the same lines as the former heater, constructed to withstand up to 250 lbs. steam pressure. Use of cast iron is in accordance with a WPB permit.

EXPORT LICENSING REGULATIONS

Under the Export of Goods (Control) (No. 41) Order, 1942, which comes into force on November 16, licences will be required to export the following classes of goods to all destinations:—

Cooking and heating appliances (non-electrical) of the following descriptions, and parts and accessories therefor, wholly or mainly of metal:—Bainmaries, cookers, cooking ovens, food steamers, grillers, heating plates, hotcupboards, plate warmers, toasters and waffle plates; boilers, boiling plates, boiling rings, boiling tables, calorifiers, coffee percolators, steam raisers, urns and water heaters; convectors, radiators and towel rails; ranges, stoves and grates; any combinations of the above.

Harness and saddlery, wholly or partly of non-precious metal, and fittings wholly or partly of non-precious metal of a kind used on harness and saddlery.

Electrical goods of the following descriptions:—Cooking and heating appliances of the following descriptions, and parts and accessories therefor, wholly or mainly of metal:—Bainmaries, cookers, cooking ovens, food steamers, grillers, heating plates, hotcupboards, plate warmers, toasters and waffle plates; boilers, boiling plates, boiling rings, boiling tables, coffee percolators, steam raisers, urns and water heaters, including electrode and immersion heaters; convectors, radiators, towel rails and tubular heaters; ranges, stoves and grates; any combinations of the above.

The existing licensing requirements with respect to boilers, cookers, grates, radiators, convectors, ranges and stoves (except those of a kind used for manufacturing purposes), and parts and fittings therefor, wholly or mainly of iron and steel; and stoves, paraffin, pressure type, of capacity not less than 1½ pints, but not exceeding 2 pints, are superseded by the provisions that licences will in future be required to export cooking and heating appliances (electrical and non-electrical) and parts and accessories therefor, wholly or mainly of metal, as specified above. It should be noted, in this connection, that appliances used for manufacturing purposes are no longer excepted from control.

The existing licensing requirements with respect to tin oxides, whether hydrated or not, and zinc oxide, including leaded zinc oxide and zinc sulphide (luminous), are superseded by the provisions that licences will, in future, be required to export the following:—Tin compounds and zinc compounds.

HIGHER WAGES FOR STEELWORKERS

Men in the heavy steel trades have been granted wage increases, to date from November 1, as the result of negotiations between the Iron and Steel Trades Employers' Association and the Iron and Steel Trades Confederation.

Workers aged 21 and over get 6s. a week more, between 18 and 21 the advance is 4s. 6d., and for those under 18 the increase is 3s. a week. In addition, the cost of living bonus for youths between 18 and 21 is increased from 50 per cent. to 75 per cent. of the full bonus payment.

STANTON *Dale* REFINED PIG IRON

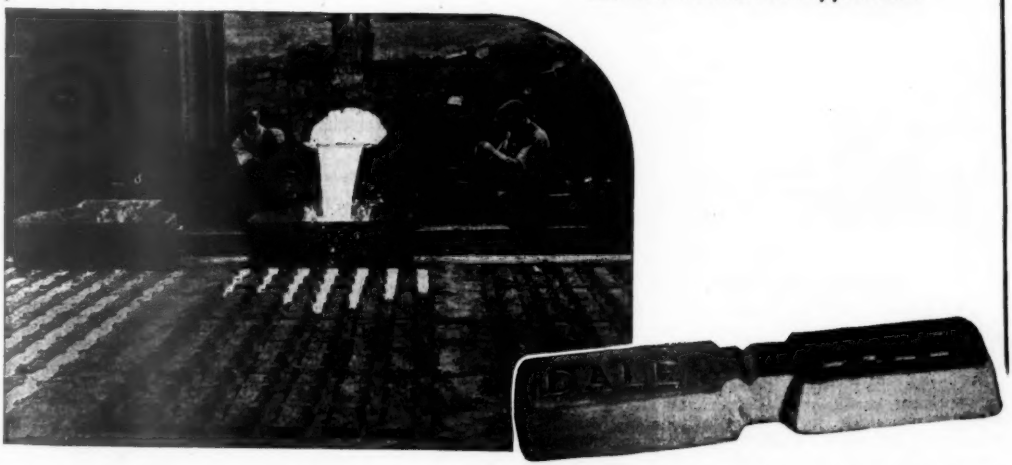
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

NEWS IN BRIEF

THE NORTHERN STEEL & HARDWARE COMPANY, LIMITED, is being wound up voluntarily. Mr. K. B. Hilton, 4, Clarence Street, Manchester, 2, is the liquidator.

THE SHIPYARD UNIONS have presented to the employers a claim for a substantial advance of wages, which has been referred to the local associations of the Shipbuilding Employers' Federation.

NEWTON CHAMBERS & COMPANY, LIMITED, Thorncliffe, Sheffield, are to offer, for five years, £100 per annum for prizes for outstanding work or Papers on the "Chemist in Industry." The money will be used at the discretion of the South Yorkshire Section of the Institute of Chemistry.

MR. ERNEST BEVIN, Minister of Labour, told delegates of the Transport and General Workers' Union in London recently that he was examining now a good many of the wage structures. In some of the industries he thought they could get them on a better basis. Some of the wage systems went back to the basis of 1880 or earlier.

SO THAT ALL old and disused tramway rails shall be treated as re-melting scrap, the Minister of Supply has issued the Control of Iron and Steel (No. 2) (Scrap) Order, 1942, which came into force on Tuesday. The Order provides that no person may treat, use or consume tramway rails, except as part of a railway or tramway track or as scrap for re-melting, unless licensed by the Minister of Supply.

THE HALIFAX MUNICIPAL TECHNICAL COLLEGE has inaugurated within the Pure and Applied Chemistry Department, grouped courses suitable for foundry apprentices and extending over four years. The courses are being held with a view to giving students a thorough training in the fundamental principles of the foundry industry. They involve a study of foundry practice, foundry science, and sufficient elementary metallurgy for the purpose. Those students who continue their studies systematically should be in a position to enter for the examinations of the City and Guilds of London Institute in Foundry Practice. The foundry practice to be done in the courses will be conducted, when necessary, in a well-equipped local foundry, by the courtesy of the proprietors. The fee for each course is 10s. to 18s., according to the stage taken.

NON-FERROUS SCRAP

The Ministry of Supply, through the Directorate of Salvage and Recovery, has issued an urgent appeal for all unwanted copper, zinc, lead, pewter, white-metal, brass, bronze and aluminium scrap. It is well known that sources of these metals, commensurate with present needs, are overseas, and so, in order to conserve shipping, it has become necessary to tap every probable source at home. In these circumstances every works and factory is urged to seek and turn out all forms of metal scrap, which may be sent either to a depot provided by the local authority or to any scrap metal merchant.

PERSONAL

MR. R. M. FAIRFIELD has been appointed process manager to Callender's Cable & Construction Company, Limited.

MR. C. K. F. HAGUE has been appointed deputy managing director of Babcock & Wilcox, Limited, but will continue to act in his capacity as director in charge of sales.

MRS. ISABEL FLAVEL has been elected chairman of Sidney Flavel & Company, Limited, ironfounders and engineers, Leamington Spa. Mr. Sidney W. B. Flavel and Mr. W. Arnold Jackson (general manager) have been appointed joint managing directors.

MR. JAMES JOHNSTONE has retired after a period of 40 years' service with the Stirling Boiler Company, Limited. For the past 23 years he occupied the position of superintendent engineer in charge of erection. Mr. D. L. Jarman has been appointed to succeed him.

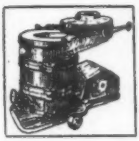
MR. W. J. PETERSON, a past-President of the South African Branch of the Institute of British Foundrymen, has just retired from the chairmanship of the Transvaal Engineers' and Founders' Association, and Mr. J. C. James has been elected to that position. Mr. Peterson, however, has been elected chairman of a new body—the Transvaal Foundry Association.

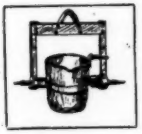
MR. A. J. BOYD, managing director of the Metropolitan-Cammell Carriage & Wagon Company, Limited, has been appointed Director-General of Fighting Vehicle Supplies at the Ministry of Supply. Mr. J. W. Kidd, the general manager of the firm, has been appointed a director of the company, and will act as managing director in Mr. Boyd's absence.

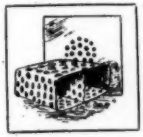
COMB-OUT OF WORKERS UNDER 25

The Ministry of Labour and National Service has announced a new and drastic comb-out of industry to provide men for the Forces. The munitions industries are not to be exempt and many of them will lose all men under 25 who are physically fit. More occupations still will lose their men under 30. Men within these age groups will be taken from a number of occupations in the iron, steel, engineering and allied industries. Before any of them are called up, however, their employers will be given an opportunity of indicating for which men they need substitutes. Where it is agreed that a substitute is needed, the man concerned will not be called up until a substitute has been supplied. The Ministry asks that employers should not enter into correspondence at this stage regarding individuals affected by this decision. The men concerned will be informed, and their employers communicated with, before calling-up action is taken.

The lists include the following occupations for workers under 25:—Enameller, japanner, etc. (metal and metal goods)—foreman, charge hand. Brass and other non-ferrous metal founder and moulder—coremaker (non-ferrous); bell founder. Iron and steel founder and moulder—coremaker (iron castings); coremaker (steel castings). Pig-iron manufacture (blast-furnace)—mine filler. Patternmaker (wood, metal, etc.)—patternmaker (grate and stove), pattern filer.







DEVELOPMENT OF MODERN FOUNDRY BLACKING TECHNIQUE

It is a long stride, in both time and moulding practice, from the era of simple charcoal blacking to the specialised and diversified requirements of this industrial age.

Research and immense experimental work have resulted in the great range of Facings now available to the foundryman, among them BONDED BLACKING, originally perfected by William Cumming & Co., Ltd., of Glasgow, Falkirk, Chesterfield, Deepfields and Middlesbrough. This now, by largely replacing imported Plumbago, is saving vital shipping.

FAH

COMPANY NEWS

(Figures for previous year in brackets.)

Manley & Regulus—Interim dividend of 5% (same).

Garrard Engineering & Manufacturing—Interim dividend of 12½% (same).

Thompson Bros. (Bilston)—Final dividend of 7½% (same) and a bonus of 7½% (5%), making 22½% (20%) for the year to July 31.

Steel Barrel, Scammells & Associated Engineers—Final ordinary dividend of 9%, plus a cash bonus of 5%, making 20% for the year to June 30 last.

Cornercroft—Profit for the year to June 18, after E.P.T., £32,592 (£30,798); income-tax, £8,500 (£6,850); final ordinary dividend of 9%, making 15% (same); forward, £3,802 (£3,467).

Linley Engineering Company—Net profit for the 12 months ended March 31, £3,666 (£1,313); to taxation reserve, £900 (£100); dividend of 7½% (5%) and a bonus of 2½% (nil); forward, £4,724 (£4,208).

Settle Limes—Net profit for the year ended July 31, after charging depreciation, interest, etc., £32,276 (£30,478); contribution under War Damage Act, £570; E.P.T., £19,000; income-tax, £8,500; dividend of 4% (same); forward, £3,002 (£2,450).

Herbert Morris—Trading profit for the year ended July 31, £127,944 (£101,694); depreciation, £15,742 (£15,737); final dividend on the ordinary shares of 15%, free of tax, making 20%, tax free (same); forward, after preference dividend, £66,711 (£64,703).

Hughes-Johnson Stampings—Net profit for the year to August 2, after making provision for E.P.T. and income-tax and charging £13,146 (£13,100) depreciation, £32,343 (£25,159); dividend of 25%, including 10% bonus (same); deferred repairs and renewals, £50,000; forward, £48,987.

Thos. W. Ward—Net profit for the year ended June 30, after interest, reserve for taxation, and £49,008 for depreciation, £134,884 (£143,221); final ordinary dividend of 7½%, less tax, on the ordinary shares, making 11¼% (same); to reserve, £25,000; forward, £127,890 (£126,048).

William Doxford & Sons—Net profit for the year to June 30, after providing for taxation, £157,618 (£155,932, less £50,000 transferred to reserve for taxation); to general reserve, £25,000; to reserve for contingencies, £30,000; distribution of 1% (same) in respect of participating rights, making 6% on the preference shares; final dividend of 11% on the ordinary shares, making 15% (12½%); forward, £47,122 (£34,504).

IMPORTS OF BAUXITE

With effect from November 9, the Board of Trade has revoked the Open General Licence permitting the importation without separate licence of bauxite and cryolite, natural and synthetic. On and after that date separate licences will be required, except in the case of goods despatched to the United Kingdom before November 9, 1942, and imported before January 9, 1943. Applications for licences should be sent to the Import Licensing Department, Board of Trade, 1-6, Tavistock Square, London, W.C.1.

OBITUARY

MR. PAUL HENRY KOHN-SPEYER, chairman of Brandeis Goldschmidt & Company, Limited, metal merchants, died recently, at the age of 74. He had been a member of the London Metal Exchange since 1894, and was an outstanding personality in the metal trade.

THE DEATH IS announced of Mr. James Ross, for twenty years foreman patternmaker with the Fullwood Foundry Company, Limited. He was a member of the Scottish Branch of the Institute of British Foundrymen for many years, and was always ready to do whatever he could to advance the interests of the Institute and the prestige of the Branch.

MR. DAVID ROSS, general works manager of the Malleable Works of the South Durham Steel & Iron Company, Limited, died at his home at Stockton-on-Tees recently. He was in his 57th year. Formerly manager for the British Mannesmann Tube Company at Newport, Mon., he first went to Tees-side 18 years ago to superintend the new tube industry at the malleable works. He took a special interest in technical and higher education, being a governor of the Stanton Secondary School.

MR. JAMES MCCULLUM, who died recently at Evanston, Illinois, was the joint designer with Mr. Peter Burt of the Bristol sleeve-valve engine. Many years ago these men, working separately on somewhat similar lines, agreed to co-operate and as a result they succeeded in designing a single-sleeve valve which was satisfactorily embodied in the engine of the Argyll car. Later it was incorporated in the Barr & Stroud motor cycle. Then, nearly twenty years ago, the Bristol Aeroplane Company developed the idea with a view to employing it in aircraft engines, which they eventually did, and have since developed a number of highly successful sleeve-valve engines.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Dohm, 115-125, Streatham Hill, London, S.W.12—Ironfounders, engineers, tool makers, etc. £5,000.

Herbert C. Atkins & A. C. Gill, 2-12, Warser Gate, Nottingham—Ironfounders, engineers, etc. £2,000.

Higginson & Company (Engineers), 9, Hurst Street, Liverpool—£7,000. A. E. G. Williams and C. Higgs.

Leon Beilin—Brass, iron and metal founders, etc. £1,000. H. Beilin and Henri Beilin, 64, Menelik Road, London, N.W.2.

John H. Ratzer, Wrotham Place, Kent—Machinery designers and manufacturers, tool makers, etc. £7,500. R. E. and J. H. W. Ratzer.

Burnand & Day, 36, William Mount Street, Liverpool, 5—Engineers, tool makers, founders, etc. £1,500. F. E. Day and G. G. Burnand.

Kilmington Engineering Works, Gammons Hill, Axminster, Devon—Agricultural engineers. £1,000. E. F. Cox, J. T. Triggs and L. J. S. Bagg.

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requests all Managements—
in the National interest—to
Save Fuel
Coal, Coke, Gas & Fuel Oil
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INSULATE
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Raw Material Markets

IRON AND STEEL

Activity in most sections of the iron and steel industry is maintained. With few exceptions, all departments are operating at or near capacity levels and producers are being called upon to deliver unprecedented supplies so that the output of war materials may be kept up. Ironfoundries producing heavy castings are sharing in the business placed by the various Government departments, but light-castings makers are receiving little official work. Many of the latter have certainly reported rather more active conditions during the past week or two, but this section of the industry will shortly come completely under the Government's plans for the concentration of industry. There is still talk of there being a resumption of activity in housebuilding and, should this come about, demand for light castings is bound to be affected. Meanwhile, very few of these works are able to operate on a full-time basis. After the cessation of hostilities, no doubt, the light foundry trade will enjoy a long period of full-scale employment.

Engineering castings are still being absorbed at a fast rate, as these castings are used extensively by Government contractors. Whereas makers of light castings utilise mainly high-phosphorus iron, heavy engineering concerns are taking up better-quality irons, which are produced from ores found outside the United Kingdom, the supply of which depends on the amount of shipping which can be allocated for this type of cargo. Moderate tonnages of medium-phosphorus iron and refined grades are forthcoming, but the volume of hematite and low-phosphorus irons released by the Control authorities is very small. A fair amount of steel scrap is being incorporated in mixtures, and is proving valuable as a substitute.

Stocks of foundry coke at many consuming points are substantial, as most users having the necessary accommodation have filled the available space during the summer months as a precaution against deliveries becoming delayed later in the year. As yet, however, there has been no interruption to arrivals, and buyers relying on weekly deliveries have not been disappointed. For delivery to Birmingham and Black Country stations, the current price of Durham best foundry coke is 69s. 3d. per ton, this figure being fixed by the Control authorities.

There continues to be intense pressure in the steel trade for all types of special and alloy steel, which are wanted for the aircraft and munition works, etc. Production has been enlarged from time to time, but it is still insufficient to satisfy all demands. Plates are taken up as fast as they become available, shipbuilders leading the way in placing orders for steel plates, although large demands are also forthcoming from wagon and tank makers, etc. Sheet mills are briskly employed, particularly those engaged on the production of special qualities.

The national collection campaign certainly relieved the scrap situation to a large extent, but it is still necessary for efforts to be made to acquire fresh supplies of heavy scrap. Merchants have as much of the lighter sorts as they can handle and many are overwhelmed with quantities of railings, etc., but there will eventually be an outlet for all this material, so that the energy infused into the campaign will be duly rewarded.

NON-FERROUS METALS

The tin position in this country appears to be fairly satisfactory, and there is no suggestion of a shortage for essential purposes. In view of the situation engendered by the Japanese military achievements in the Far East, it is vitally necessary, of course, for every economy to be exercised in the use of the metal, and it cannot be expected that there will be metal to spare for ordinary domestic uses. The smelter output of the United Kingdom is being taxed to its utmost limits, as, in addition to coping with home requirements, there are other commitments on hand, including the shipment of supplies to the Soviet Union and possibly in the future to the United States, where stocks have been steadily reduced in recent months.

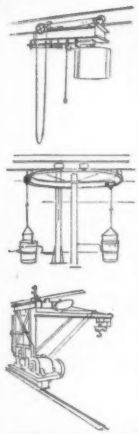
Efforts to conserve our available spelter stocks are being made, and further restrictions on the use of the metal are regularly being introduced, as it may not be possible always to rely on existing sources of supply. Demand for zinc from war factories is very extensive, and it is necessary to ensure a steady flow of metal to these consumers.

Battery makers and cable manufacturers continue to absorb large tonnages of lead, and consumption among these trades has increased appreciably since the war. On the other hand, the pipe and sheet trade, which in normal times is the biggest lead consumer, is now taking but a fraction of its usual quantities, owing to the quiet state of the building industry.

References have been made in official quarters recently to the possibility that private housebuilding may be resumed before the end of the war. Such a move would, of course, affect non-ferrous metals and lead in particular. In view of the strategic value of these metals to the war machine, it does not seem likely that any large quantities would be released for the building industry.

PAPER ECONOMY COMMITTEE

The Minister of Production has appointed a Paper Economy Committee to assist him in obtaining a reduction in the consumption of paper. The Committee will examine all cases of excessive use of paper and take the necessary steps to effect economy. Further economy in the use of paper is essential, and the Minister is satisfied that many economies can be obtained. He asks that all paper users will give the Committee all the help in their power in order that the necessary economies can be obtained with the least possible disturbance. The address of the Committee is 3, Central Buildings, Westminster, S.W.1, and communications offering suggestions will be welcomed.



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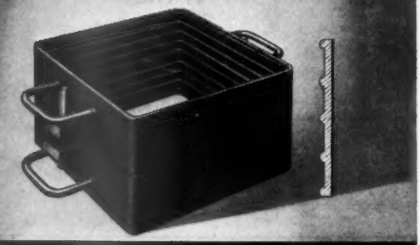

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PUBLISHED WEEKLY : 21s. per annum (Home and Overseas).

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